

Supporting Information

van Zonneveld et al. 10.1073/pnas.1718045115

Text S1

R packages used in the analyses of the present study are as follows: “rgbif” (1), “raster” (2), “dismo” (3), “sp” (4), “rgeos”

(5), “rgdal” (6), “geosphere” (7), and “maptools” (8), “ggplot” (9), “doBy” (10), and “agricolae” (11).

1. Chamberlain S, Barve V, Mcglinn D (2017) rgbif: Interface to the Global Biodiversity Information Facility API, R package Version 0.9.9. Available at <https://cran.r-project.org/web/packages/rgbif/rgbif.pdf>. Accessed February 24, 2018.
2. Hijmans R, et al. (2017) raster, R package Version 2.6-7. Available at <https://cran.r-project.org/web/packages/raster/raster.pdf>. Accessed February 24, 2018.
3. Hijmans R, Phillips S, Leathwick J, Elith J (2017) dismo, R package 1.1-4. Available at <https://cran.r-project.org/web/packages/dismo/dismo.pdf>. Accessed February 24, 2018.
4. Pebesma E, et al. (2018) sp: Classes and Methods for Spatial Data, R package 1.2-7. Available at <https://cran.r-project.org/web/packages/sp/sp.pdf>. Accessed February 24, 2018.
5. Bivand R, Rundel C, Pebesma E, Stuetz R, Hufthammer KO (2017) rgeos: Interface to Geometry Engine-Open Source (GEOS), R package Version 0.3-26. Available at <https://cran.rstudio.com/web/packages/rgeos/rgeos.pdf>. Accessed February 24, 2018.
6. Bivand R, et al. (2017) rgdal: Bindings for the Geospatial Data Abstraction, R package Version 1.2-16. Available at <https://cran.r-project.org/web/packages/rgdal/rgdal.pdf>. Accessed February 24, 2018.
7. Hijmans R, Williams E, Vennes C (2017) geosphere: Spherical Trigonometry, R package Version 1.3-11. Available at <https://cran.r-project.org/web/packages/geosphere/geosphere.pdf>. Accessed February 24, 2018.
8. Bivand R, Lewin-Koh N (2013) maptools: Tools for Reading and Handling Spatial Objects, R package Version 0.9-2. Available at <https://cran.r-project.org/web/packages/maptools/maptools.pdf>. Accessed February 24, 2018.
9. Wickham H (2009) *ggplot2: Elegant Graphics for Data Analysis* (Springer, New York).
10. Hojsgaard S (2006) The {doBy} package. *R News* 6:47–49.
11. de Mendiburu F, de Mendiburu M (2016) Statistical Procedures for Agricultural Research, R Package Version 1.2-8. Available at vps.fmvz.usp.br/CRAN/web/packages/agricolae/agricolae.pdf. Accessed January 21, 2018.

Table S1. List of identified fruits once dispersed by megafauna

Family	Taxa	Region	Refs.
Fruit-producing species part of megafauna diets but not part of human diets			
Fabaceae	<i>Acacia farnesiana</i>	Central America	1
Annonaceae	<i>Annona holosericea</i>	Central America	1
Malpighiaceae	<i>Bunchosia biocellata</i>	Central America	1
Fabaceae	<i>Chloroleucon mangense</i>	Central America	1
Fabaceae	<i>Dioclea megacarpa</i>	Central America	1
Ebenaceae	<i>Diospyros acapulcensis</i>	Central America	1
Rubiaceae	<i>Guettarda macrosperma</i>	Central America	1
Euphorbiaceae	<i>Hippomane mancinella</i>	Central America	1
Rubiaceae	<i>Randia echinocarpa</i>	Central America	1
Annonaceae	<i>Sapranthus palanga</i>	Central America	1
Sapotaceae	<i>Sideroxylon capiri</i>	Central America	1
Rhamnaceae	<i>Ziziphus guatemalensis</i>	Central America	1
Arecaceae	<i>Acrocomia intumescens</i>	South America	2
Arecaceae	<i>Allagoptera caudescens</i>	South America	2
Fabaceae	<i>Andira anthelmia</i>	South America	2
Fabaceae	<i>Andira humilis</i>	South America	2
Fabaceae	<i>Andira legalis</i>	South America	2
Arecaceae	<i>Attalea dahlgreniana</i>	South America	2
Solanaceae	<i>Duckeodendron cestroides</i>	South America	2
Myrtaceae	<i>Eugenia neoverrucosa</i>	South America	2
Arecaceae	<i>Manicaria saccifera</i>	South America	2
Arecaceae	<i>Mauritia carana</i>	South America	2
Sapotaceae	<i>Pouteria pachycalyx</i>	South America	2
Sapotaceae	<i>Pouteria torta</i>	South America	2
Sapotaceae	<i>Pouteria venosa</i>	South America	2
Fabaceae	<i>Swartzia langsdorffii</i>	South America	2
Fabaceae	<i>Swartzia macrostachya</i>	South America	2
Fabaceae	<i>Swartzia oblate</i>	South America	2
Arecaceae	<i>Syagrus cearensis</i>	South America	2
Arecaceae	<i>Syagrus macrocarpa</i>	South America	2
Wild fruit-producing species that have been part of both human and megafauna diets			
Araceae	<i>Bactris major</i>	Central America	1
Bromeliaceae	<i>Bromelia karatas</i>	Central America	1
Bromeliaceae	<i>Bromelia penguin</i>	Central America	1
Moraceae	<i>Brosimum alicastrum</i>	Central America	1
Moraceae	<i>Maclura tinctoria</i>	Central America	1
Anacardiaceae	<i>Spondias radlkoferi</i>	Central America	1
Arecaceae	<i>Allagoptera leuocalyx</i>	South America	2
Apocynaceae	<i>Ambelania acida</i>	South America	2
Bromeliaceae	<i>Ananas ananassoides</i>	South America	2
Annonaceae	<i>Annona cacans</i>	South America	2
Annonaceae	<i>Annona coriacea</i>	South America	2
Annonaceae	<i>Annona crassiflora</i>	South America	2
Annonaceae	<i>Annona densicoma</i>	South America	2
Anacardiaceae	<i>Antrocaryonam azonicum</i>	South America	2
Arecaceae	<i>Astrocaryum aculeatissimum</i>	South America	2
Arecaceae	<i>Astrocaryum aculeatum</i>	South America	2
Arecaceae	<i>Astrocaryum murumuru</i>	South America	2
Arecaceae	<i>Attalea dubia</i>	South America	2
Arecaceae	<i>Attalea maripa</i>	South America	2
Arecaceae	<i>Attalea phalerata</i>	South America	2
Achariaceae	<i>Carpotroche brasiliensis</i>	South America	2
Caryocaraceae	<i>Caryocar microcarpum</i>	South America	2
Caryocaraceae	<i>Caryocar villosum</i>	South America	2
Fabaceae	<i>Cassia leiandra</i>	South America	2
Humiriaceae	<i>Duckesia verrucosa</i>	South America	2
Myrtaceae	<i>Eugenia klotzschiana</i>	South America	2
Myrtaceae	<i>Eugenia stipitata</i>	South America	2
Myrtaceae	<i>Eugenia supraaxillaris</i>	South America	2
Fabaceae	<i>Geoffroea spinosa</i>	South America	2
Fabaceae	<i>Hymenaea stigonocarpa</i>	South America	2
Fabaceae	<i>Inga alba</i>	South America	2

Table S1. Cont.

Family	Taxa	Region	Refs.
Fabaceae	<i>Inga capitata</i>	South America	2
Fabaceae	<i>Inga cinnamomea</i>	South America	2
Fabaceae	<i>Inga heterophylla</i>	South America	2
Fabaceae	<i>Inga laurina</i>	South America	2
Fabaceae	<i>Inga macrophylla</i>	South America	2
Fabaceae	<i>Inga ruiziana</i>	South America	2
Fabaceae	<i>Inga sessilis</i>	South America	2
Fabaceae	<i>Inga thibaudiana</i>	South America	2
Fabaceae	<i>Inga velutina</i>	South America	2
Quiinaceae	<i>Lacunaria jenmanii</i>	South America	2
Chrysobalanaceae	<i>Parinari montana</i>	South America	2
Clusiaceae	<i>Platonia insignis</i>	South America	2
Sapotaceae	<i>Pouteria caimito</i>	South America	2
Sapotaceae	<i>Pouteria grandiflora</i>	South America	2
Sapotaceae	<i>Pouteria macrocarpa</i>	South America	2
Sapotaceae	<i>Pouteria macrophylla</i>	South America	2
Sapotaceae	<i>Pouteria pariry</i>	South America	2
Sapotaceae	<i>Pouteria ramiflora</i>	South America	2
Sapotaceae	<i>Pouteria speciosa</i>	South America	2
Malvaceae	<i>Quararibea cordata</i>	South America	2
Annonaceae	<i>Rollinia mucosa</i>	South America	2
Celastraceae	<i>Salacia crassifolia</i>	South America	2
Solanaceae	<i>Solanum lycocarpum</i>	South America	2
Arecaceae	<i>Syagrus cocoides</i>	South America	2
Arecaceae	<i>Syagrus oleracea</i>	South America	2
Arecaceae	<i>Syagrus picrophylla</i>	South America	2
Arecaceae	<i>Syagrus pseudococos</i>	South America	2
Malvaceae	<i>Theobroma obovatum</i>	South America	2
Malvaceae	<i>Theobroma subincanum</i>	South America	2
Cultivated fruit-producing species that have been part of both human and megafauna diets			
Araceae	<i>Acrocomia aculeata</i>	Central/South America	1, 2
Fabaceae	<i>Albizia saman</i>	Central America	1
Rubiaceae	<i>Alibertia edulis</i>	Central America	1
Annonaceae	<i>Annona purpurea</i>	Central America	1
Annonaceae	<i>Annona reticulate</i>	Central America	1
Araceae	<i>Bactris guineensis</i>	Central America	1
Malpighiaceae	<i>Byrsonima crassifolia</i>	Central America	1
Rubiaceae	<i>Genipa Americana</i>	Central/South America	1, 2
Fabaceae	<i>Hymenaea courbaril</i>	Central/South America	1, 2
Sapotaceae	<i>Manilkara zapota</i>	Central America	1
Fabaceae	<i>Prosopis juliflora</i>	Central America	1
Anacardiaceae	<i>Spondias mombin</i>	Central America	1
Anacardiaceae	<i>Spondias purpurea</i>	Central America	1
Anacardiaceae	<i>Anacardium giganteum</i>	South America	2
Anacardiaceae	<i>Anacardium occidentale</i>	South America	2
Bromeliaceae	<i>Ananas comosus</i>	South America	2
Annonaceae	<i>Annona montana</i>	South America	2
Annonaceae	<i>Annona muricata</i>	South America	2
Arecaceae	<i>Astrocaryum vulgare</i>	South America	2
Caryocaraceae	<i>Caryocar brasiliense</i>	South America	2
Chrysobalanaceae	<i>Coupe bracteosa</i>	South America	2
Chrysobalanaceae	<i>Couepia subcordata</i>	South America	2
Fabaceae	<i>Dipteryx alata</i>	South America	2
Humiriaceae	<i>Endopleura uchi</i>	South America	2
Clusiaceae	<i>Garcinia macrophylla</i>	South America	2
Clusiaceae	<i>Garcinia madruno</i>	South America	2
Fabaceae	<i>Inga edulis</i>	South America	2
Fabaceae	<i>Inga semialata</i>	South America	2
Chrysobalanaceae	<i>Licania tomentosa</i>	South America	2
Sapotaceae	<i>Manilkara zapota</i>	South America	2
Arecaceae	<i>Mauritia flexuosa</i>	South America	2
Icacinaeae	<i>Poraqueiba paraensis</i>	South America	2

Table S1. Cont.

Family	Taxa	Region	Refs.
Icacinaceae	<i>Poraqueiba sericea</i>	South America	2
Anacardiaceae	<i>Spondias tuberosa</i>	South America	2
Malvaceae	<i>Theobroma bicolor</i>	South America	2
Malvaceae	<i>Theobroma cacao</i>	South America	2
Malvaceae	<i>Theobroma grandiflorum</i>	South America	2

1. Janzen DH, Martin PS (1982) Neotropical anachronisms: The fruits the gomphotheres ate. *Science* 215:19–27.

2. Guimarães PR, Jr, Galetti M, Jordano P (2008) Seed dispersal anachronisms: Rethinking the fruits extinct megafauna ate. *PLoS One* 3:e1745.

Table S2. Genera that include fruit species from different diet groups and their geographic and climatic ranges with the uncorrected datasets

Genus	Species	Family	Diet groups	EOO, M km ²	EOO for land only, M km ²	MGD, DD	RAMT, C°	RAP, m
<i>Acrocomia</i>	<i>aculeata</i>	Arecaceae	Cultivated	20.2	14.3	76.8	15.1	4,589
<i>Acrocomia</i>	<i>intumescens</i>	Arecaceae	Megafauna only	0.9	0.9	21.4	8.7	1,255
<i>Allagoptera</i>	<i>caudescens</i>	Arecaceae	Megafauna only	0.2	0.1	14.4	6	1,223
<i>Allagoptera</i>	<i>leucocalyx</i>	Arecaceae	Wild producing	3.9	3.9	27.1	8.9	1,756
<i>Annona</i>	<i>montana</i>	Annonaceae	Cultivated	15.9	12.4	57.1	8.7	4,607
<i>Annona</i>	<i>muricata</i>	Annonaceae	Cultivated	22.0	13.9	80.5	14.8	4,667
<i>Annona</i>	<i>purpurea</i>	Annonaceae	Cultivated	5.1	2.5	40.1	12.7	3,850
<i>Annona</i>	<i>reticulata</i>	Annonaceae	Cultivated	20.2	13.7	78.8	13.9	3,400
<i>Annona</i>	<i>holosericea</i>	Annonaceae	Megafauna only	0.3	0.2	11.3	8.5	2,568
<i>Annona</i>	<i>cacans</i>	Annonaceae	Wild producing	3.5	3.3	29.4	11.1	1,392
<i>Annona</i>	<i>coriacea</i>	Annonaceae	Wild producing	5.4	5.4	28.6	9.4	2,770
<i>Annona</i>	<i>crassiflora</i>	Annonaceae	Wild producing	3.6	3.6	25.5	9.6	1,794
<i>Annona</i>	<i>densicoma</i>	Annonaceae	Wild producing	1.9	1.9	29.5	2.2	1,489
<i>Attalea</i>	<i>dahlgreniana</i>	Arecaceae	Megafauna only	0.7	0.7	14.0	1.2	845
<i>Attalea</i>	<i>dubia</i>	Arecaceae	Wild producing	0.2	0.1	9.1	8.8	1,266
<i>Attalea</i>	<i>maripa</i>	Arecaceae	Wild producing	6.3	6.3	33.3	3.9	2,419
<i>Attalea</i>	<i>phalerata</i>	Arecaceae	Wild producing	5.8	5.8	34.1	8.7	3,099
<i>Eugenia</i>	<i>neoverrucosa</i>	Myrtaceae	Megafauna only	0.7	0.7	17.7	7.3	1,469
<i>Eugenia</i>	<i>klotzschiana</i>	Myrtaceae	Wild producing	1.2	1.2	19.3	5.9	1,107
<i>Eugenia</i>	<i>stipitata</i>	Myrtaceae	Wild producing	9.5	8.9	53.8	9.7	3,256
<i>Eugenia</i>	<i>supraaxillaris</i>	Myrtaceae	Wild producing	1.4	1.2	23.9	8.8	2,011
<i>Mauritia</i>	<i>flexuosa</i>	Arecaceae	Cultivated	10.6	10.4	47.7	7.3	3,251
<i>Mauritia</i>	<i>carana</i>	Arecaceae	Megafauna only	0.9	0.9	14.4	2.3	1,362
<i>Pouteria</i>	<i>pachycalyx</i>	Sapotaceae	Megafauna only	0.0	0.0	2.7	0.6	190
<i>Pouteria</i>	<i>torta</i>	Sapotaceae	Megafauna only	14.5	12.4	65.5	14.4	6,917
<i>Pouteria</i>	<i>venosa</i>	Sapotaceae	Megafauna only	10.6	9.8	44.7	12.2	2,881
<i>Pouteria</i>	<i>caimito</i>	Sapotaceae	Wild producing	13.7	12.2	56.0	12.1	6,941
<i>Pouteria</i>	<i>grandiflora</i>	Sapotaceae	Wild producing	6.4	6.2	47.0	8.3	2,427
<i>Pouteria</i>	<i>macrocarpa</i>	Sapotaceae	Wild producing	5.4	5.1	52.9	6.3	3,204
<i>Pouteria</i>	<i>macrophylla</i>	Sapotaceae	Wild producing	9.3	9.0	43.5	8.5	2,450
<i>Pouteria</i>	<i>pariry</i>	Sapotaceae	Wild producing	3.9	3.9	26.0	2.7	1,436
<i>Pouteria</i>	<i>ramiflora</i>	Sapotaceae	Wild producing	6.5	6.4	33.0	14.1	2,334
<i>Pouteria</i>	<i>speciosa</i>	Sapotaceae	Wild producing	4.1	4.1	31.3	4.5	2,160
<i>Syagrus</i>	<i>cearensis</i>	Arecaceae	Megafauna only	0.2	0.2	5.7	5.8	1,240
<i>Syagrus</i>	<i>macrocarpa</i>	Arecaceae	Megafauna only	0.2	0.2	11.5	4.7	1,070
<i>Syagrus</i>	<i>cocooides</i>	Arecaceae	Wild producing	2.6	2.6	20.4	5.7	2,274
<i>Syagrus</i>	<i>oleracea</i>	Arecaceae	Wild producing	3.1	3.0	27.2	7.1	1,340
<i>Syagrus</i>	<i>picrophylla</i>	Arecaceae	Wild producing	0.1	0.1	7.6	3.1	213
<i>Syagrus</i>	<i>pseudococos</i>	Arecaceae	Wild producing	0.4	0.4	14.8	5.5	662

Table S3. ANOVA per geographic and environmental variable and significance levels for the effects of diet groups and region and their interaction expressed as mean squares

Variables	Diet groups [†]	Region [‡]	Diet groups × region	Residuals	Grouping Tukey post hoc tests		
					Megafauna only	Wild producing	Also cultivated
Analysis with all data							
EOO, M km ²	25,648***	12,151***	456 ^{NS}	957	A	B	C
EOO for land only	27,227***	5,529*	208 ^{NS}	989	A	B	C
MGD, DD	22,818***	20,096***	935 ^{NS}	931	A	B	C
RAMT, °C	7,488**	19,093***	248 ^{NS}	1,197	A	B	B
RAP, m	14,769***	16,164***	695 ^{NS}	1,097	A	B	B
Analysis with subsampling							
EOO, M km ²	19,594***	1,239 ^{NS}	429 ^{NS}	948	A	B	C
EOO for land only	19,150***	174 ^{NS}	115 ^{NS}	971	A	B	C
MGD, DD	17,978***	7,656**	1,104 ^{NS}	909	A	B	B
RAMT, °C	2,381 ^{NS}	4,961 ^{NS}	165 ^{NS}	1,218	A	A	A
RAP, m	7,497**	4,920 ^{NS}	436 ^{NS}	1,125	A	B	B

NS, not significant.
 * $P < 0.05$, ** $P < 0.01$, and *** $P < 0.001$, FDR method.
[†]Fixed factor.
[‡]Random effect.